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**Smith et al.**

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(54) **WEBBING ADJUSTER FOR A SEAT BELT ASSEMBLY**

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(51) **Int. Cl.**

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| ***B60R 22/02*** | (2006.01) |
| ***B60N 2/68*** | (2006.01) |
| ***B60N 2/24*** | (2006.01) |
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| *B60R 22/18* | (2006.01) |

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(58) **Field of Classification Search**

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USPC ........... 280/802, 804, 806; 297/468, 469, 483

See application file for complete search history.

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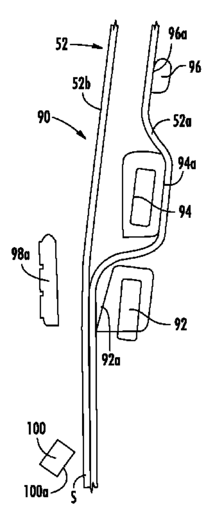
(57) **ABSTRACT**

A webbing adjuster for a seat belt system having a webbing, the webbing adjuster including a main body having a base and a guide portion configured to limit a forward movement of the webbing relative to the base, the base having a friction element and a passage configured to route the webbing from a front side to a rear side of the base, and a lower guide member connected to the main body and configured to limit the forward movement of the webbing. When the webbing is not under load, the webbing adjuster is configured to be moveable relative to the webbing. When the webbing is under load, the friction element is configured to secure the webbing to maintain a relative position between the webbing adjuster and the webbing.

**19 Claims, 6 Drawing Sheets**



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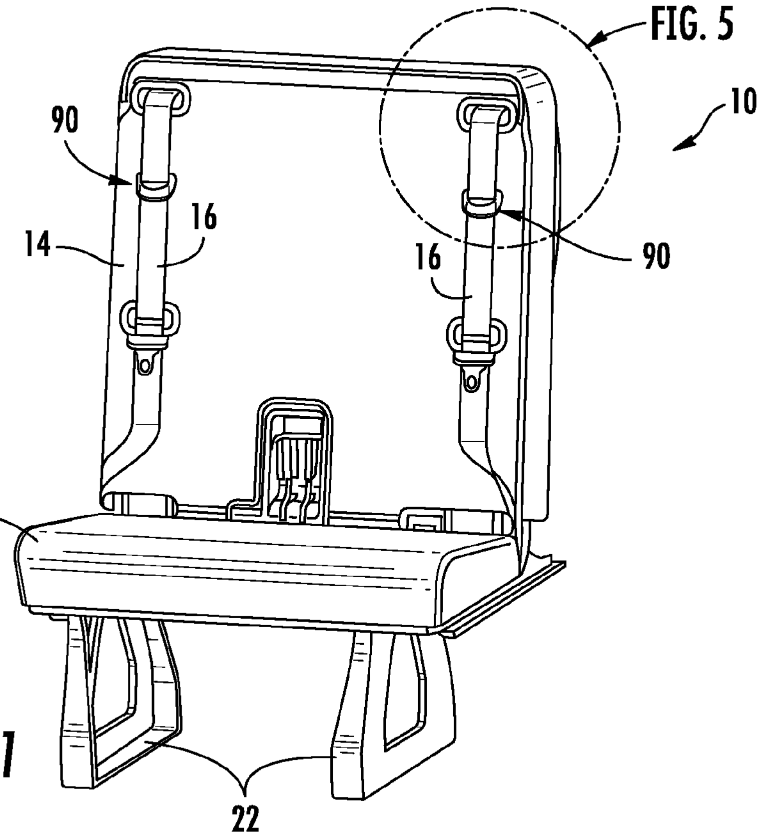



FIG. 1

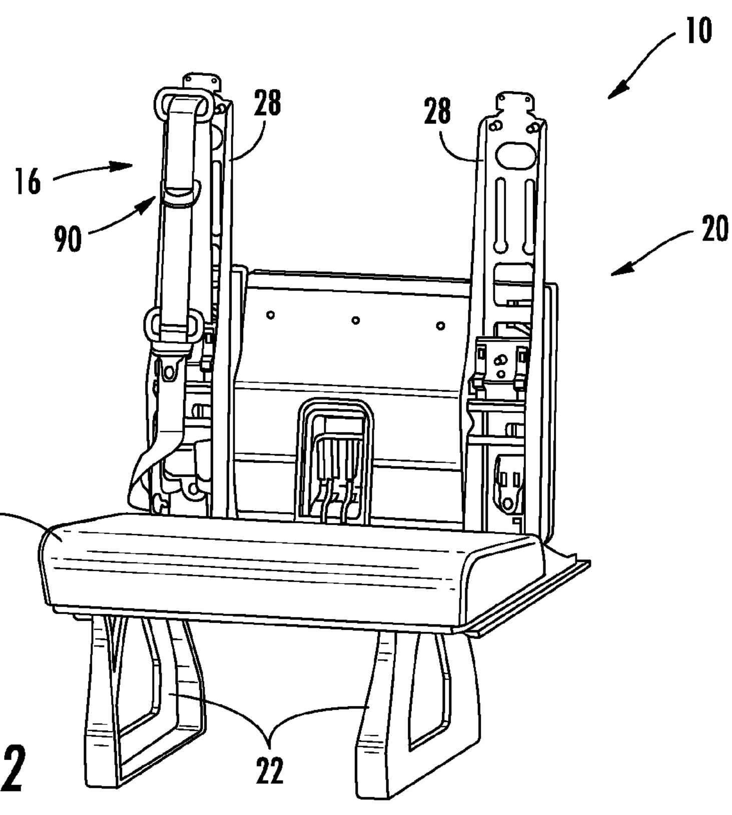
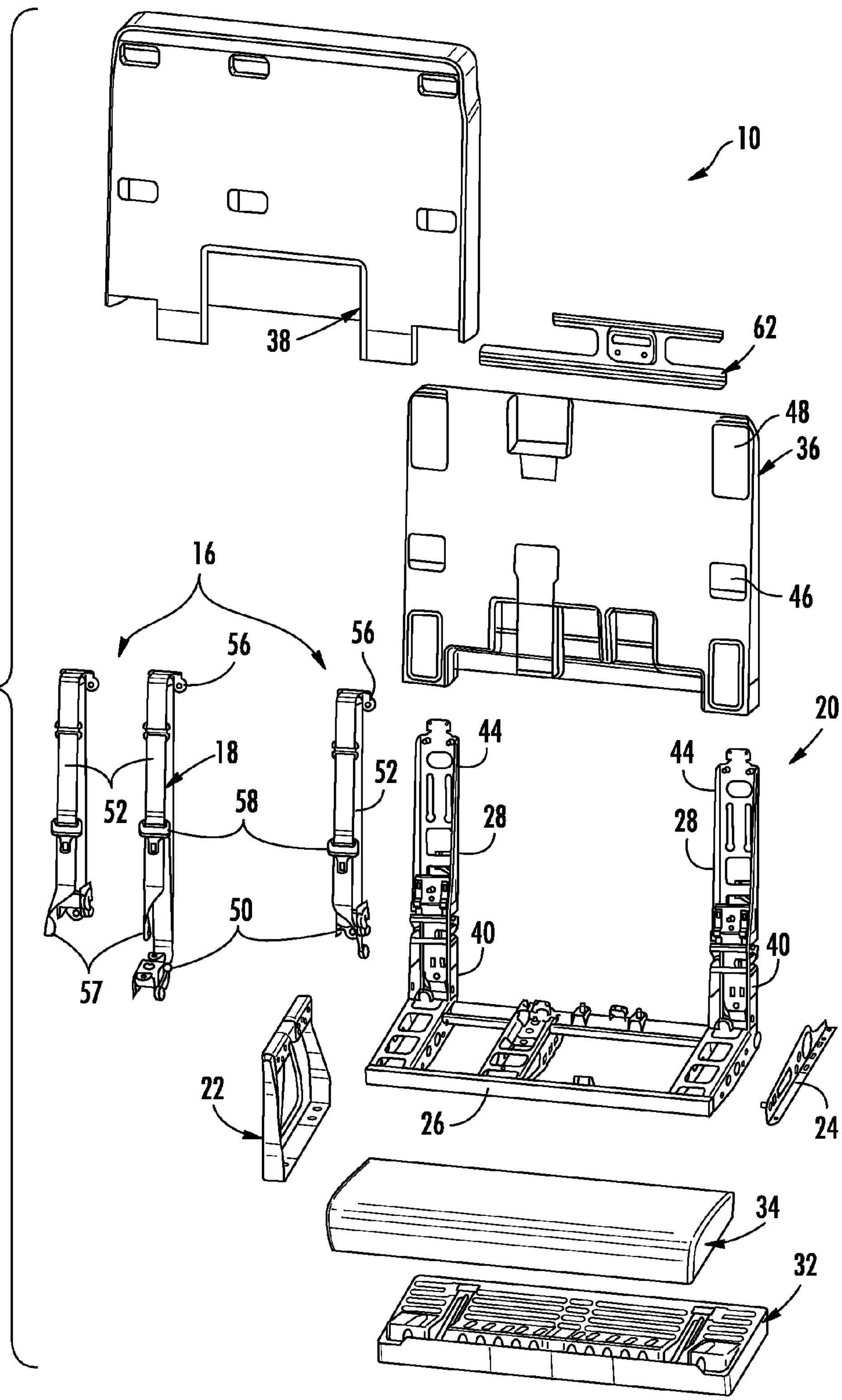



FIG. 2

FIG. 3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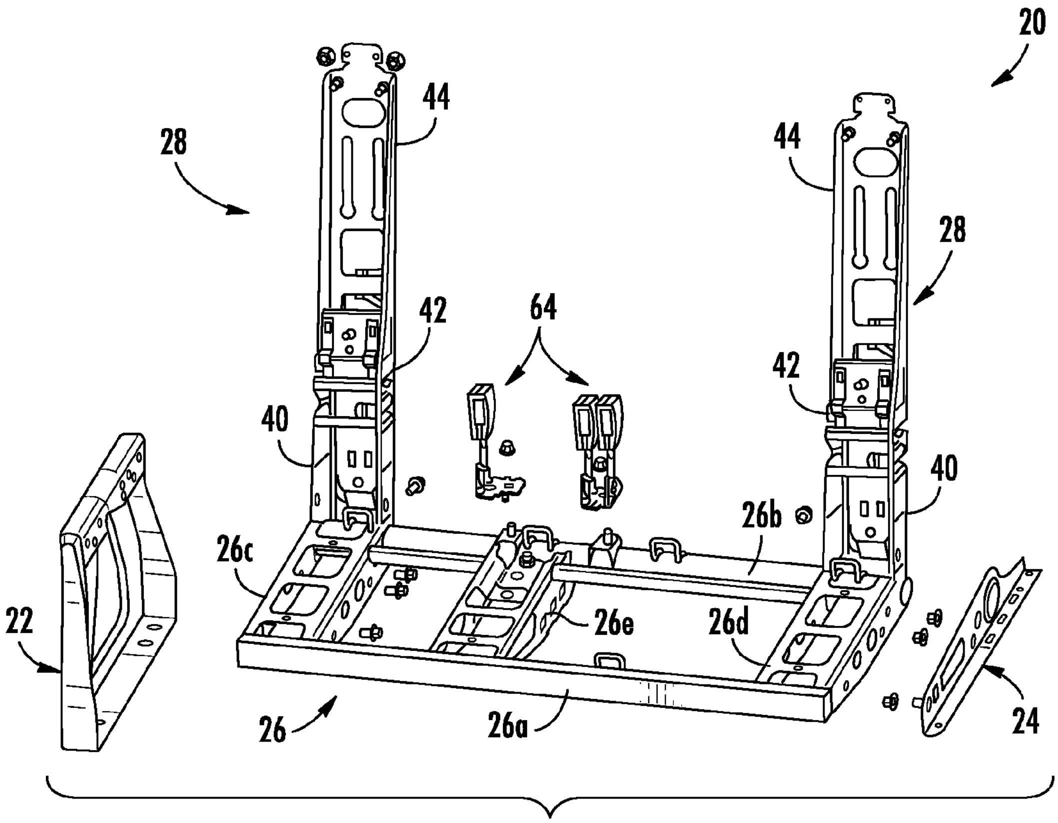
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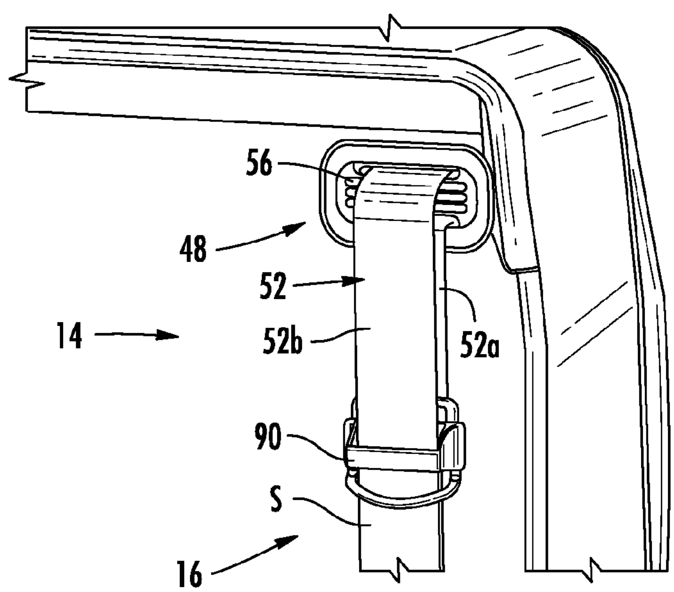
FIG. 4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52b
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FIG. 5

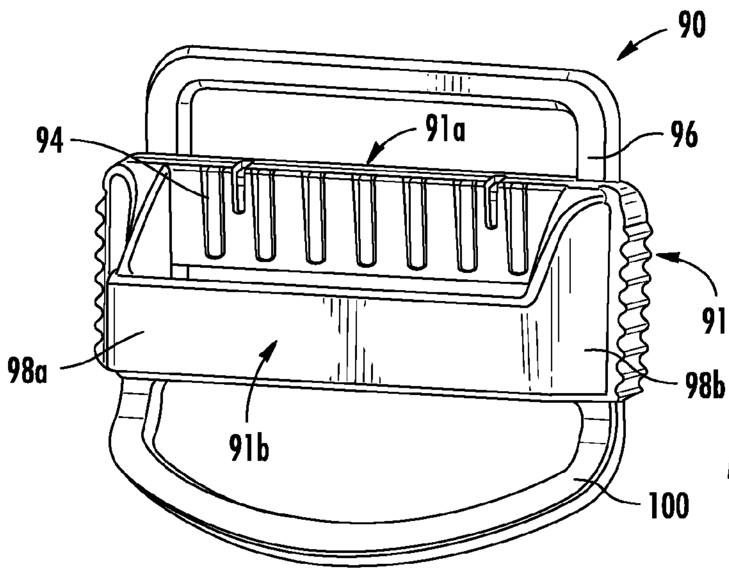


FIG. 6

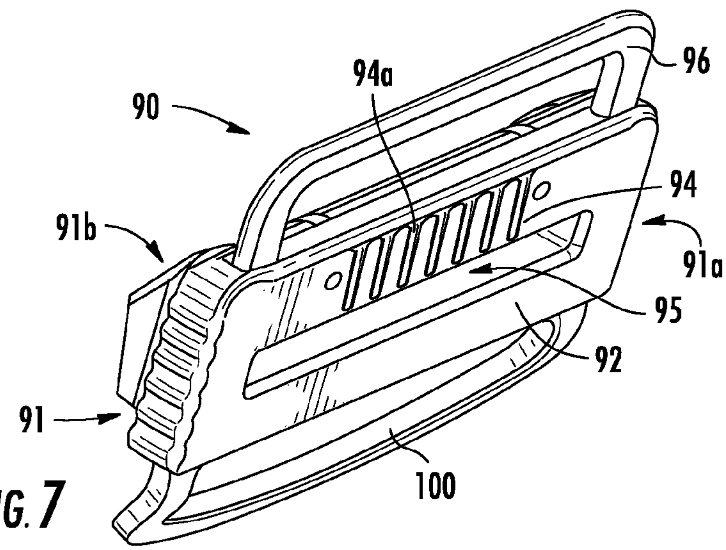


FIG. 7

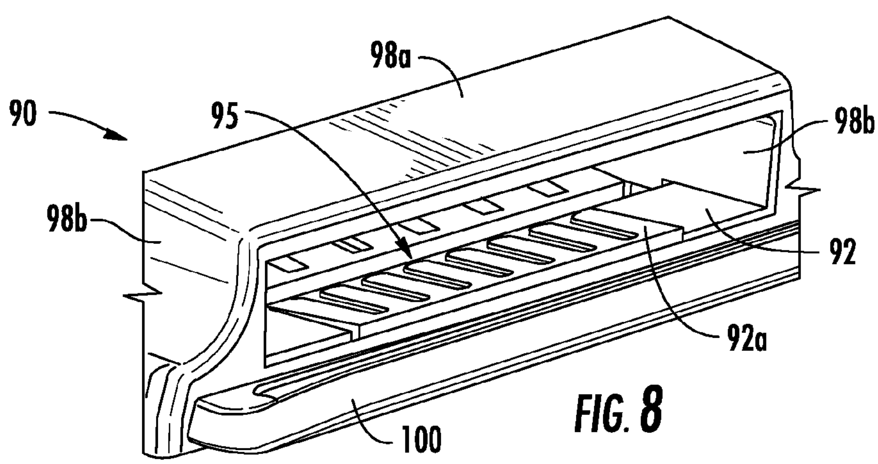


FIG. 8

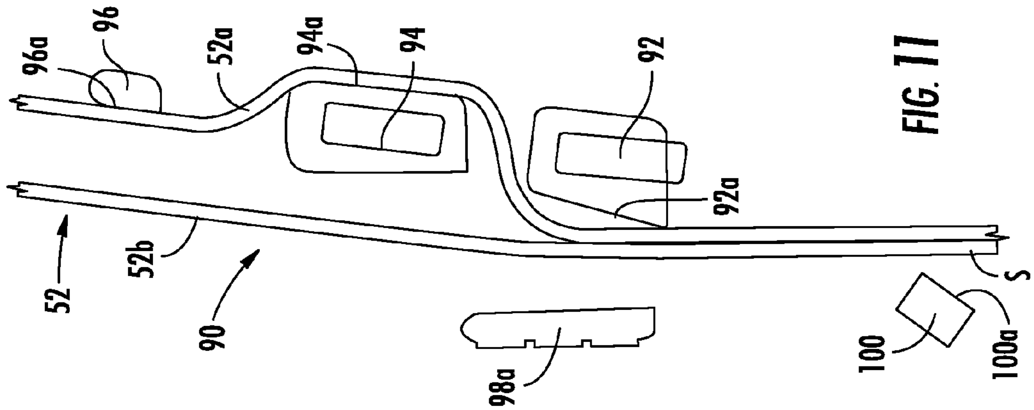


FIG. 11

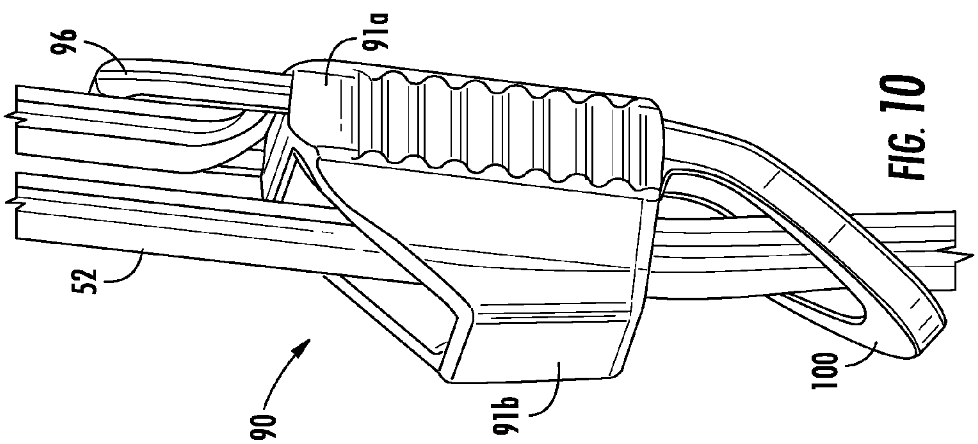


FIG. 10

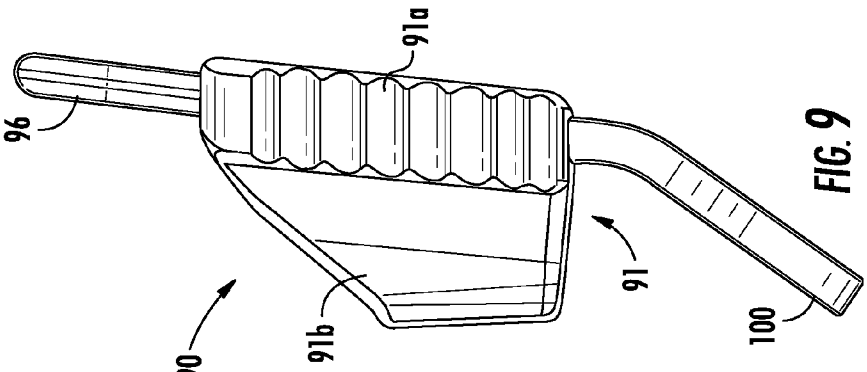


FIG. 9

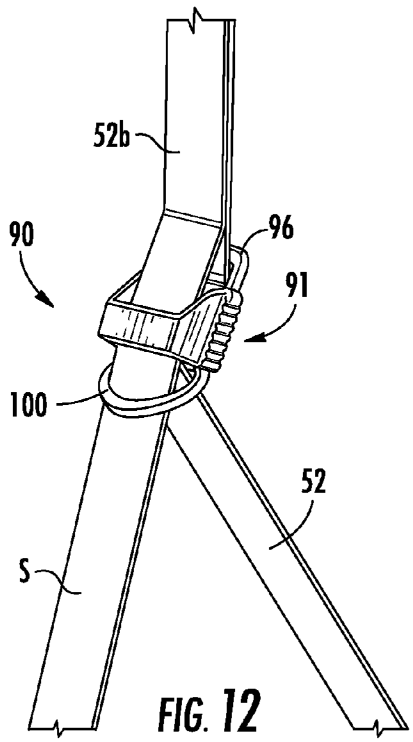


FIG. 12

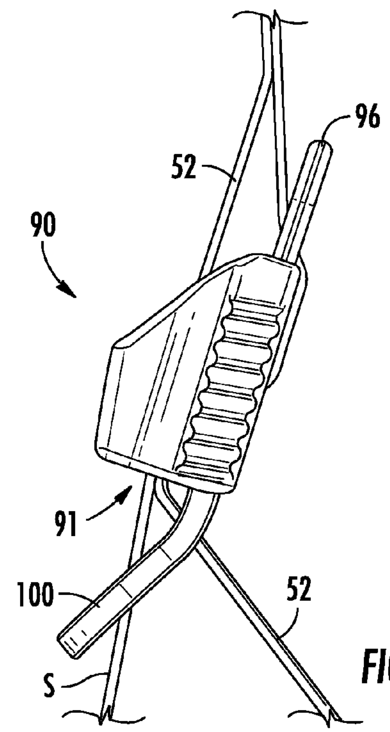


FIG. 13

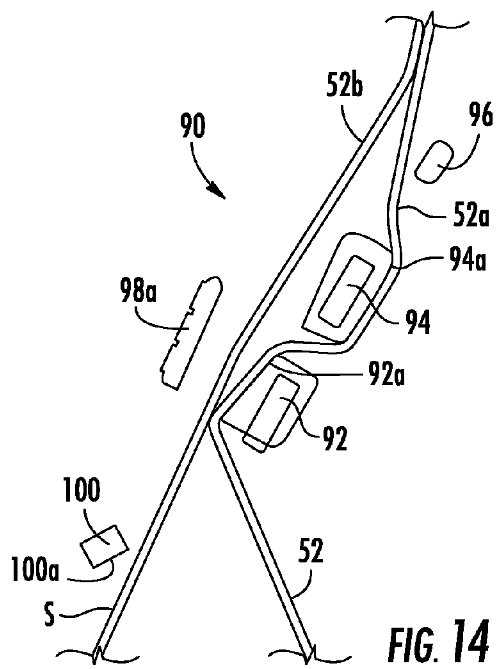


FIG. 14

# WEBBING ADJUSTER FOR A SEAT BELT ASSEMBLY

## CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

This application claims the benefit and priority to U.S. Provisional Patent Application 61/481,010, filed Apr. 29, 2011. U.S. Provisional Patent Application 61/481,010 is incorporated by reference herein in its entirety.

## BACKGROUND

The present application relates to the field of seat belt systems (e.g., occupant restraint devices) configured for use with vehicles. More specifically, the present application relates to seat belt systems for vehicle seats having an improved moveable webbing adjuster to accommodate different sizes of occupants.

## SUMMARY

One embodiment relates to a webbing adjuster for a seat belt system having a webbing. The webbing adjuster includes a main body and a lower guide member. The main body includes a base and a guide portion configured to limit a forward movement of the webbing relative to the base, the base having a friction element and a passage configured to route the webbing from a front side to a rear side of the base. The lower guide member is connected to the main body and configured to limit the forward movement of the webbing. When the webbing is not under load, the webbing adjuster is configured to be moveable relative to the webbing. When the webbing is under load, the friction element is configured to secure the webbing to maintain a relative position between the webbing adjuster and the webbing.

Another embodiment relates to a seat belt assembly for restraining an occupant of a vehicle. The seat belt assembly includes a webbing and a webbing adjuster coupled only to the webbing. The webbing adjuster includes a main body and a lower guide member. The main body has a base and a guide portion configured to limit a forward movement of the webbing relative to the base, the base having a friction element and a passage configured to route the webbing from a front side to a rear side of the base. The lower guide member is connected to the main body and configured to limit the forward movement of the webbing. When the webbing is not under load, the webbing adjuster is configured to be moveable relative to the webbing. When the webbing is under load, the friction element is configured to secure the webbing to maintain a relative position between the webbing adjuster and the webbing.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a seat assembly according to an exemplary embodiment.

FIG. **2** is a perspective view of part of the seat assembly of FIG. **1**.

FIG. **3** is a partially exploded perspective view of another exemplary embodiment of a seat assembly.

FIG. **4** is a partially exploded perspective view of part of the seat assembly of FIG. **3**.

FIG. **5** is a detail view of part of the seat assembly of FIG. **1**.

FIG. **6** is a front perspective view of a webbing adjuster according to an exemplary embodiment.



FIG. **7** is rear perspective view of the webbing adjuster of FIG. **6**.

FIG. **8** is a bottom perspective view of the webbing adjuster of FIG. **6**.

FIG. **9** is a side view of the webbing adjuster of FIG. **6**.

FIG. **10** is a perspective view of the webbing adjuster of FIG. **6** shown with a webbing routed through the webbing adjuster and in a resting position.

FIG. **11** is a cross-sectional view of the webbing and the webbing adjuster of FIG. **9** in the resting position.

FIG. **12** is a perspective view of the webbing adjuster of FIG. **6** shown with a webbing routed through the webbing adjuster and in an active position or loaded condition.

FIG. **13** is a side view of the webbing and the webbing adjuster of FIG. **12**.

FIG. **14** is a cross-sectional view of the webbing and the webbing adjuster of FIG. **13** in an active position.

## DETAILED DESCRIPTION

Referring generally to the Figures, disclosed herein are seat belt systems, configured for use in vehicles, such as mass transit vehicles, to restrain and secure occupants of the vehicle. The seat belt assemblies include a webbing and a webbing adjuster slideably coupled to the webbing. The webbing adjusters are configured to be selectively moveable relative to a webbing to accommodate different sized (e.g., height) occupants. For example, the webbing adjusters may be moved or adjusted relative to a seat belt or webbing to raise or lower the webbing adjuster relative to a shoulder of the occupant. The webbing adjuster may include a body, which may define a passage for the webbing to route therethrough. The webbing adjuster may include a guide element to help guide the webbing. For example, the webbing adjuster may include three guide elements provided at different locations to help guide the webbing routed through the webbing adjuster. The body may include a guide element. The body may include a member configured to support the webbing. For example, the body may include a first member having a first friction element and a second member having a second friction element, where the first and second members support the webbing at different locations. The members may be spaced apart to allow the webbing to route between the members. When a threshold load is applied to the webbing, such as during a vehicle dynamic event that induces the occupant to load the webbing, the webbing adjuster is configured to selectively secure the webbing to maintain a relative position between the webbing adjuster and the webbing.

A vehicle (e.g., a passenger vehicle) includes a seat assembly, such as seat assembly **10**, to provide seating to one or more occupants and to absorb energy during a dynamic vehicle event, such as a crash or other sudden acceleration/deceleration. A mass transit vehicle, such as a bus, includes a plurality of seat assemblies **10** that are configured to absorb energy during a dynamic vehicle event. Components of the seat assembly **10** work cooperatively, such that the seat assembly **10** may bend or deflect according to the various Federal Motor Vehicle Safety Standards. More particularly, FMVSS 222 includes quasi-static testing that provides force, displacement, and energy absorption requirements for a sequence of forward forces applied to the rear of the seat back, forward forces applied through the seatbelts, and rearward forces applied to the front of the seat back. Quasi-static testing is generally used to simulate dynamic loading of the seat assembly, such as through a static test arrangement of the seat assembly utilizing progressive loading of the seat assembly. The seat assembly may instead or additionally be configured to conform other standards, such as FMVSS 207 and 210, or may be configured according to other requirements, such as for other jurisdictions or other applications.

FIG. **1** illustrates an exemplary embodiment of a seat assembly **10** including a seat bottom **12**, seat back **14**, and a seat belt assembly **16** configured to secure and restrain a seated occupant (not shown). The seat assembly **10** may include more than one seat belt assembly **16** and generally includes the number of seat belt assemblies equal to the seating capacity of the seat. For example, the seat assembly **10** having a seating capacity of two occupants may include two seat belt assemblies **16**, each seat belt assembly **16** configured to secure one occupant. Also for example, a seat assembly **10** may include a pair of outer seat belt assemblies **16** configured to secure two outboard occupants and a center seat belt assembly **18** configured to secure a center occupant provided between the two outboard occupants, as shown in FIG. **3**.

As shown in FIG. **2**, seat assembly **10** also includes a seat frame **20** or seat structure configured to provide the structurally integrity (e.g., strength, durability, etc.) of the seat assembly **10**. In other words, the seat frame **20** is configured to manage the loads, such as during a dynamic vehicle impact of the vehicle (or a quasi-static test). The seat frame **20** may manage the loads by absorbing energy during loading of the seat assembly **10**. The loading of the seat assembly **10** may be caused by the forces generated by the seat belt system **16** restraining the secured occupant during a sudden deceleration or impact by the vehicle, particularly when the seat belt system **16** is coupled to the seat assembly **10**.

FIG. **3** illustrates the seat frame **20** of seat assembly **10** in an exploded view for clarity. In addition to providing the structure for the seat assembly **10**, the seat frame **20** also generally defines the shape (e.g., outline, profile, etc.) of the seat assembly **10**, such as the seat bottom **12** and the seat back **14**. As shown, each of the seat belt assemblies **16**, **18** is configured to attach to the seat frame **20** to restrain a passenger secured in the seat assembly **10** by the seat belt assembly **16**, **18** during a dynamic vehicle event.

The seat frame **20** of the seat assembly **10** includes a back frame and a frame bottom **26**. The seat frame **20** may also include a pedestal **22** (e.g., a riser) and/or a mounting bracket **24**. The back frame may include a beam **28** (e.g., tower, support, etc.). As shown in FIG. **3**, the back frame includes two generally vertical beams **28** and a back panel **36**. The pedestal **22**, the mounting bracket **24**, the frame bottom **26**, and the back frame (e.g., the beams **28**) may each be made of a rigid material (e.g., steel, other metal, composite, plastic, combinations, thereof, etc.) and are interconnected or coupled together through any suitable assembly process (e.g., by welding, adhesives, fasteners, integral formation, combinations thereof, etc.), so as to generally define the shape of the seat bottom **12** and the seat back **14**. According to other exemplary embodiments, frame components may be made from other materials (e.g., other metals, composites, plastics, combinations thereof, etc.), may be made according to other manufacturing methods (e.g., rolling, extrusions, molding, etc), may be coupled together in different manners (e.g., adhesives, fasteners, press- or tolerance-fit, combinations thereof, etc.), and the like. It should be noted that the seat frame may include any number of structural members interconnected using any suitable assembly process or method, and the embodiments disclosed herein are not limiting.

The pedestal **22** and mounting bracket **24** are configured to elevate the seat bottom **12** and seat back **14** above a bottom surface of the bus, such as a floor. The pedestal **22** and mounting bracket **24** are each configured to rigidly mount the seat assembly **10** to the mounting surface of the bus. For example, the seat assembly **10** may be rigidly attached to the floor (not shown) through the pedestal **22** and/or rigidly attached to a wall (not shown) of the vehicle through the mounting bracket **24**. The pedestal **22** and mounting bracket **24** may, for example, be coupled to the bus by any suitable method, which may include, for example, welding, fasteners, and mechanisms, which may be releasable mechanisms, not releasable mechanisms, removable mechanisms, etc. For example, the seat assembly **10** may be configured to be selectively removable from the vehicle through floor latch mechanisms, which may engage strikers in the floor of the vehicle. According to other exemplary embodiments, the seat assembly **10** may be mounted to the bus in other manners. For example, the frame **20** may include two spaced-apart pedestals **22** with each pedestal **22** being provided on one of two opposing sides of the seat assembly **10**, such as using fasteners, another bracket, or any manner suitably adapted for a particular vehicle or application.

The seat assembly **10** may also include a bottom panel **32** and/or a cover **34** (e.g., a trim cover, covering, etc.). For example, the frame bottom **26**, the bottom panel **32**, and cover **34** may cooperatively define the shape of the seat bottom **12**, which is configured to support one or more passengers thereon. The cover **34** may include an outer fabric layer disposed around an inner cushioned layer (e.g., a cushion), such as an inner foam layer. The outer fabric layer of the cover **34** may provide improved aesthetics and the cushion may provide cushioned support for the seated occupants. Thus, the frame bottom **26** provides the structure for supporting the passengers, while the bottom panel **32** is coupled to the frame bottom **26** and provides a surface for supporting the cover **34** that the passengers are seated on. The cushion and/or cover **34** may have any suitable shape and/or arrangement, such as being tailored to provide comfort for the seated occupants or passengers.

The frame bottom **26** is disposed above and is rigidly coupled to the pedestal **22**, such as by welding, fasteners, or a combination thereof. The frame bottom **26** of the frame **20** may include one member or a plurality of interconnected members. As shown in FIG. **4**, the frame bottom **26** includes a front cross-member **26*a*** (e.g., front sideward-extending member), a rear cross-member **26*b*** (e.g., rear sideward-extending member) and left-side member **26*c*** (e.g., left forward-extending member), a right-side member **26*d*** (e.g., right forward-extending member), and a center member **26*e*** (e.g., a middle forward-extending member). The members **26*a*-26*e*** may have any suitable shape, such as tubular, and may have any suitable cross-section, such as C-shaped, U-shaped, or L-shaped. The members **26*a*-26*e*** of the frame bottom **26** may be coupled together, such as through welding (e.g., MIG, TIG, laser, etc.) to form a generally horizontal seat structure or support. It should be noted that the frame bottom **26** may include more or fewer members and may include other structural elements, such as support member or additional cross-members, and the embodiments disclosed herein are not limiting. Further, the frame bottom **26** may be coupled to the pedestal **22** in different manners (e.g., fasteners, press- or tolerance-fit, integral formation, etc.), or any suitable combinations thereof.

The seat assembly **10** may also include a back cover **38** (e.g., a trim cover, covering, etc.). The back cover **38** may include an outer fabric layer disposed around an inner cushioned layer (e.g., a cushion), such as an inner foam layer. For example, the back cover **38** together with the beams **28** and the back panel **36** of the back frame may cooperatively define the shape of the seat back **14**, which is configured to support the backs of one or more passengers. The seat back **14** may also define passenger compartments in front of and behind the seat back **14**. The beams **28** provide the structure for supporting the passengers, while the back panel **36** provides a surface that supports the back cover **38** against which the passengers may lean. The cushion and/or cover **34** may have any suitable shape and/or arrangement, such as being tailored to provide comfort for the seated occupants or passengers.

Also shown in FIG. **3**, the beams **28** are elongated stamped steel members having a generally U-shaped cross-section. Each beam **28** includes a lower end **40** (e.g., lower portion), a middle portion **42** (e.g., intermediate portion, central portion, etc.), and an upper end **44** (e.g., upper portion). As shown, the lower ends **40** of the beams **28** are rigidly coupled to opposite ends of the frame bottom **26** in a manner that prevents relative rotation between lower ends **40** of the beams **28** and the frame bottom **26** (e.g., by welding). However, it should be noted that the lower ends **40** may be connected to the frame bottom **26** through a mechanism (e.g., recliner) to provide an adjustable seat back **14** relative to the seat bottom **12**. The middle portions **42** of the beams **28** may be configured for energy absorption. The upper ends **44** of the beams **28** are configured to provide an upper harness point (e.g., an attachment) for the seat belt assemblies **16**. According to other exemplary embodiments, the beams **28** may be made from different materials (e.g., other metals, composites, plastics, etc.), may be made according to different manufacturing processes (e.g., stamping, rolling, molding, etc.), may have different geometry (e.g., tubular, solid, different cross-section shape, varying geometry, etc.), and the like in suitable combinations for the seat assembly **10** described herein.

The back panel **36** may be a blow molded unitary plastic member or piece having receptacles disposed at opposite ends of a panel portion. Each receptacle is a generally vertical, hollow chamber having a bottom opening configured to receive one of the beams **28** therein. The receptacles have a shape and size that corresponds with the cross-sectional shape and size of the beams **28**. The back panel **26** may also include a middle opening **46** and an upper opening **48** through which seat belt webbing may pass. For example, the openings **46**, **48** may pass from a front surface of the back panel **26** to the receptacles.

The back panel **36** may be coupled to the beams **28**, such as at the upper ends **44**, through any suitable method, such as using fasteners (e.g., rivets, bolts, etc.), so as to prevent relative motion between the back panel **36** and beams **28** and to impart structural rigidity between the beams **28** and back panel **36**. The back panel **36** defines a generally flat forward surface to support the back cover **38** against which a passenger may lean or rest. The back panel **36** may also include various structural features, such as ribs, of varying size and shape to provide the back panel **36** with structural integrity independent of the beams **28** to support passengers.

Each seat assembly (e.g., the seat assembly **10**) may include one or more than one seat belt assembly (e.g., the seat belt assembly **16**, the seat belt assembly **18**) configured to restrain a passenger or occupant of the vehicle, such as to transfer energy and loads from the passenger to the seat assembly during a dynamic vehicle event. As shown in FIG. **1**, the seat assembly **10** includes a pair of seat belt assemblies **16** configured to restrain up to two seated passengers. As shown in FIG. **3**, the seat assembly **10** may include two outboard seat belt assemblies **16** and one inboard seat belt assembly **18** configured to restrain up to three seated passengers. Each seat belt assembly **16**, **18** forms a three-point harness configured to restrain a passenger in the seat assembly **10** during a dynamic vehicle event, such as a crash or sudden vehicle deceleration.

According to an exemplary embodiment, the seat belt assembly **16** includes a webbing **52**, a tongue member **58** slideably attached to the webbing **52**, a buckle mechanism **64** (e.g., latch mechanism) configured to selectively receive and retain (e.g., lock) the tongue member **58**, and a webbing adjuster **90**. According to other exemplary embodiments, each seat belt assembly **16**, **18** may include a webbing **52**, a retractor **50** (e.g., a retractor mechanism), a buckle mechanism **64** (e.g., a latch mechanism), a tongue member **58** that is configured to selectively engage the buckle mechanism **64**, an upper bracket **56** to help guide the webbing **52**, a lower anchor member **57** to secure an end of the webbing **52**, and a webbing adjuster **90** configured to be adjustable relative to the webbing **52**.

The webbing **52** of the seat belt assembly **16**, **18** includes a first end **53** and a second end **54**. As shown in FIG. **3**, the first end **53** of the webbing **52** is coupled to the retractor **50** (e.g., retractor mechanism), which may be fixed or connected to the seat frame **20** (e.g., beam **28**, frame bottom **26**, or pedestal **22**). For example, the first end **53** may be coupled to a rotatable spool of the retractor **50**, such that the webbing **52** may be wound/unwound from the spool to allow retraction/extraction of the webbing **52** from the retractor **50**. Thus, the retractor **50** provides for selective storage and release of the webbing **52** depending on whether a passenger is seated or moving into or out of the seat assembly **10**. The refractor **50** also functions to lock or hold the webbing **52** in tension against the passenger (i.e., to prevent extraction of the webbing) to prevent further release of the webbing **52** during a dynamic vehicle event. The retractor **50** may also be configured to pretension the webbing **52** during a dynamic vehicle event by retracting a portion of the webbing **52** into the refractor **50** to remove slack or clearance between the secured occupant and the webbing **52**, such as to limit the movement (e.g., displacement) of the occupant.

Each refractor **50** is rigidly coupled to a lower portion of the seat frame **20**, such as with the use of fasteners, and is covered by another seat component, such as the seat back panel **36** and/or seat back cover **38**. For example, each retractor **50** for each outboard seat belt assembly **16** may be coupled to the lower end **40** of one of the beams **28** and may be partially disposed in the U-Shaped channel of the beam **28**. Also for example, the retractor **50** for the inboard seat belt assembly **18** may be coupled to the frame **20** or pedestal **22**, such as to the rear cross-member **26***b*. According to other exemplary embodiments, the retractor mechanisms may be coupled to any other suitable elements or portions of the frame **20**, or may be coupled to any suitable rigid attachment location in the vehicle (e.g., bus).

As shown in FIG. **3**, the webbing **52** extends upward from the refractor **50** and is configured to route through the middle or intermediate opening **46** of the seat back panel **36** and/or seat back cover **38**, so as to be exposed or external to the seat back **14**. As shown in FIG. **5**, the webbing **52** then extends or routes back through the upper opening **48** of the seat back panel **36** and an upper bracket **56** that is rigidly coupled to the upper end **44** (e.g., upper portion) of the beam **28**. The upper bracket **56** forms or defines an upper or shoulder harness attachment location/point for the webbing of the seat belt assembly **16**. The portion of the webbing **52** that is routed back out of the upper bracket **56** is configured to receive the webbing adjuster **90** to define a shoulder portion S of the webbing **52** which then routes over the shoulder and torso of the occupant. For the inboard seat belt assemblies **18**, the upper bracket **56** may, for example, be coupled to a rigid anchor plate or panel **62** that is configured to be coupled to a middle or upper portion on the rear surface of the seat back panel **36**.

The second end **54** of the webbing **52** may be fixed relative to the seat belt assembly **16**, **18**. For example, the second end **54** may be fixedly coupled to the seat frame **20** (e.g., beam **28**, frame bottom **26**, or pedestal **22**) by way of a fastener, such as a bolt and a nut, or by any other suitable fastening means or connecting method.

The tongue member **58** is configured to slide along the webbing **52** and to selectively (e.g., releasably or disengageably) couple to the buckle mechanism **64**, which may be fixed to the seat frame **20** (e.g., frame bottom **26** or pedestal **22**). The tongue member **58** divides the webbing into the shoulder portion S and a lap portion that is configured to route over the lap of the secured passenger. Thus, the tongue member **58** is slideably coupled to the webbing **52** to provide for comfort adjustment by allowing the secured passenger to slide the tongue member **58** along the webbing **52** to adjust the length of the lap portion and the length of the shoulder portion S of the webbing **52**. The tongue member **58** and the buckle mechanism **64** may have any suitable configuration. One buckle mechanism **64** may be provided for each seat belt assembly **16**, **18**. Alternatively, additional and redundant buckle mechanisms **64** may be provided to provide various seating arrangements to accommodate different passenger configurations.

The webbing adjuster **90** of the seat belt assembly **16**, **18** is configured to adjust the position of the seat belt webbing **52** that extends from the upper bracket **56** to the tongue member **58** and/or buckle mechanism **64** to accommodate passengers of different size. For example, by lowering or raising the webbing adjuster, the shoulder portion of the webbing may be adjusted to begin near to (e.g., above) the passenger's shoulder. In other words, the webbing adjuster **90** is slideably attached to the webbing **52** relative to the fixed upper bracket **56** (and other stationary seat components) to allow the passenger to adjust the length of the shoulder portion S of the webbing **52**. Accordingly, each passenger can adjust the shoulder portion S for comfort by moving the webbing adjuster **90** along the webbing **52** either away from or toward the upper bracket **56**. The webbing adjuster **90** is also configured to maintain or lock the webbing in position during a dynamic vehicle event and during testing. In other words, during a dynamic vehicle event, the webbing adjuster **90** is configured to prohibit relative movement between the webbing adjuster **90** and the webbing **52**.

According to an exemplary embodiment, the webbing adjuster **90** is a unitary, molded (e.g., injection molded) piece having various members, portions, elements and/or ribs that are integrally formed together. According to another exemplary embodiment, the webbing adjuster **90** is made from several separate components, which are then coupled together.

As shown in FIGS. **6-9**, the webbing adjuster **90** includes a main body **91** having a base **91***a* and a guide portion **91***b* configured to limit a forward movement of the webbing routed through the main body **91** relative to the base **91***a*. The base **91***a* and guide portion **91***b* may be integrally formed together or may be formed separately and coupled together. The webbing adjuster **90** may also include one or more than one guide member. As shown, the webbing adjuster **90** includes an upper guide member **96** and a lower guide member **100**.

The base **91***a* of the main body **91** may have any suitable shape or configuration, such as, for example, being generally planar. The base **91***a* includes a passage **95** configured for the webbing **52** to route or pass therethrough. For example, the passage **95** may be configured to allow the webbing **52** to route from a front side of the base **91***a* to a rear side of the base **91***a*. The passage **95** may be transversely configured in the base **91***a* to route the webbing **52** at an angle, such as, for example, about 90°, relative to the portions of the webbing adjacent to the front and rear sides of the base **91***a*.

The base **91***a* of the main body **91** may include a first member **92** and a second member **94**, where each member may have any suitable configuration and may be disposed anywhere on the main body **91**. For example, the members **92**, **94** may have a generally rectangular cross-section with rounded corners (e.g., edges). The members **92**, **94** are spaced apart to define the passage **95** to allow the webbing **52** to pass between the members, as shown in FIG. **11**, and the spacing may be changed or reconfigured, such as to accommodate different seat belt assembly arrangements. The spacing (i.e., the gap) between the members **92**, **94** is at least large enough to permit the webbing **52** to pass through. In other words, the first member **92** is spaced apart from the second member **94** so that the webbing **52** can route between the members **92**, **94** through the passage **95**.

For example, the first and second members **92**, **94** may be configured as opposing rib features. The base **91***a* (e.g., first and second members **92**, **94**) may be provided below the upper guide member **96** and may be generally aligned with or offset from the upper guide member **96**. The first member **92** may be disposed generally below the second member **94**, which may be disposed generally below the upper guide member **96**.

The guide portion **91***b* of the main body **91** may have any suitable configuration, such as having a generally C-shaped cross-section (when viewed from above or below) to define a channel with the base **91***a* for the webbing **52** to route therethrough. As shown in FIG. **11**, the guide portion **91***b* includes a front wall **98***a* that is disposed forward of the base **91***a* and two opposing side walls **98***b* that interconnect the front wall **98***a* to the base **91***a*. The guide portion **91***b* is configured to guide the webbing and to limit a forward movement of the webbing relative to the base **91***a*. Thus, the guide portion **91***b* defines the size of the channel in which the webbing **52** is routed through and also helps retain the webbing **52** in the channel. It should be noted that the guide portion **91***b* may include additional walls, such as forward walls. Further, the webbing adjuster **90** may also include additional guide portions.

The base **91***a* of the main body **91** may also include a friction element. The friction element of the base **91***a* may be configured to help secure the webbing to maintain a relative position between the webbing adjuster **90** and the webbing **52**, such as when the webbing **52** is under loading (e.g., induced by the secured occupant during a dynamic vehicle event). The friction element may have any suitable configuration, such as, for example, being a plurality of grooves, a plurality of protrusions, or a combination thereof. The friction element is configured to increase the friction between the webbing **52** and the webbing adjuster **90** during a dynamic vehicle event to prevent relative movement between the webbing **52** and the webbing adjuster **90**. In other words, the friction element of the member(s) helps the webbing adjuster **90** lock the webbing **52** in place during a dynamic vehicle event.

The friction element may be provided on one or more than one surface of the base **91***a* (and/or the guide portion **91***b*) of the main body **91**. For example, each of the first and second members **92**, **94** of the base **91***a* may include a friction element provided thereon. As shown in FIG. **11**, a generally forward facing surface **92***a* of the first member **92** includes a friction element disposed thereon, and a generally rearward facing surface **94***a* of the second member **94** includes a friction element disposed thereon. Thus, the friction elements may be provided on the surfaces of the base **91***a* (e.g., the respective members **92**, **94**) that are configured to engage or directly contact the webbing **52**.

The upper guide member **96** may have any suitable configuration, shape, and location. As shown in FIGS. **9-11**, the upper guide member **96** is generally configured as a C-shaped member (e.g., a rod) that is connected to the main body **91**. The upper guide member **96** may be disposed above the base **91***a* and generally in line with the first and second members **92**, **94** of the base **91***a*. Accordingly, the upper guide member **96** may be distally located relative to the main body **91** of the webbing adjuster **90**. As shown in FIG. **11**, the upper guide member **96** is configure to route the webbing from the rear side of the base **91***a* back to the front side. The upper guide member **96** may limit the movement of the webbing in a rearward direction (e.g., into the seat).

The lower guide member **100** may have any suitable configuration, shape, and location. As shown in FIGS. **9-11**, the lower guide member **100** is generally configured as a C-shaped member (e.g., a rod) that is connected to the main body **91**. The lower guide member **100** may be disposed generally below or downward of the guide portion **91***b* (e.g., the front wall **98***a*) and generally forward and downward from the base **91***a* (e.g., the first member **92**). Accordingly, the lower guide member **100** may be distally located relative to the main body **91** of the webbing adjuster **90**. As shown in FIG. **11**, the lower guide member **100** is configured to limit the movement of the webbing in a forward direction (e.g., away from the seat). The lower guide member **100** may be configured at an angle, such a forward oblique angle, relative to the base **91***a*. The angle may advantageously help induce a bind on the webbing to further assist the friction element in securing the webbing in position relative to the webbing adjuster when the webbing is under load or subjected to loading.

The webbing **52** of the seat belt assemblies **16**, **18** is woven through the webbing adjuster **90**. As shown in FIGS. **5** and **11**, the portion **52***a* of the webbing **52** that extends between the retractor **50** and the upper bracket **56** is routed (e.g., threaded) in front of the first member **92**, then behind the second member **94**, and then in front of the upper guide member **96**. in other words, the webbing adjuster **90** is configured to route the webbing **52** from the front side of the base **91***a* to the rear side of the base **91***a* through the passage **95**, then the upper guide member **96** routes the webbing **52** back to the front side. Thus, the portion **52***a* of the webbing **52** may be adjacent to or abutting the forward facing surface **92***a* of the first member **92** and the rearward facing surface **94***a* of the second member **94**, which may include friction elements disposed thereon. The portion **52***a* may also be provided adjacent to or abutting a forward facing surface **96***a* of the upper guide member **96**.

The webbing **52** may then extend upwardly away from the webbing adjuster **90** into the upper bracket **56**, where the webbing **52** may form a loop around the upper bracket **56**, such that a second portion **52***b* of the webbing **52** exits the upper bracket **56**. The second portion **52***b* may extend from the upper bracket **56** in a substantially downward direction. The second portion **52***b* of the webbing **52** (e.g., which may extend from the upper bracket **56** to the tongue member **58**) is routed (e.g., threaded) back into the webbing adjuster **90** in the channel defined by the base **91***a* and guide portion **91***b* of the main body **91** (i.e., in front of the first and second members **92**, **94** and behind the front wall **98***a* of the guide portion **91***b*). The second portion **52***b* of the webbing **52** then continues to route or extend downwardly behind the lower guide member **100** and beyond the lower guide member **100** to form the shoulder portion S of the webbing **52**.

A passenger may use the webbing adjuster **90** to change the position of the webbing that extends from the upper bracket **56** to the tongue member **58**. In other words, the passenger may move (e.g., slide) the webbing adjuster **90** along the webbing **52** to change the height of the webbing adjuster **90** relative to the upper bracket **56** to thereby adjust the length of the shoulder portion S of the webbing **52**. Thus, the seat belt assembly **16**, **18** may be adjusted for comfort, such as to accommodate the specific height of the passenger. Accordingly, the seat belt assembly **16** may be readjusted to accommodate the different heights of different passengers. By sliding the webbing adjuster **90** generally up or down, the webbing **52** is pulled behind the front wall **98***a* and is also pulled behind and/or under the lower guide member **100** to effectively change the upper harness position of the seat belt assembly **16**, **18**. For example, a passenger may position the webbing to be proximate a shoulder region to run below a neck region of the passenger.

The webbing adjuster **90** may be configured to remain relatively stationary relative to the upper bracket **56** during normal operation. In other words, once the passenger has adjusted the position of the webbing adjuster **90** to the preferred comfort position, the webbing adjuster **90** remains relatively fixed in the adjusted position. For example, the friction force between the webbing adjuster **90** and the webbing **52** may overcome the force of the weight of the webbing adjuster **90** allowing the webbing adjuster **90** to maintain its relative adjusted position. The friction elements of the members may help induce the friction force between the webbing adjuster **90** and the webbing **52**. Further, the relative routing of the webbing **52** through the webbing adjuster **90** may induce the necessary friction force to maintain the position of the webbing adjuster **90**. The level of the friction force is configured to help hold the webbing adjuster **90** in the adjusted position relative to the webbing **52**, such as during normal operation of the vehicle, yet the friction force does not hinder or impede the adjustability of the webbing adjuster **90**. Thus, the level of the friction force may be tailored to allow the webbing adjuster **90** to be moved relative to the webbing when a threshold force is applied to the webbing adjuster **90**.

As shown in FIGS. **12-14**, the webbing adjuster **90** is configured to lock the webbing **52** in place during a dynamic vehicle event, such as a crash, or quasi-static testing of FMVSS 222. In other words, the during loading of the webbing **52**, such as by the secured passenger, the webbing adjuster **90** is configured to prohibit movement of the webbing adjuster **90** relative to the webbing **52**. For example, the tension in the webbing **52** may work in conjunction with the friction elements of the webbing adjuster **90** to induce the webbing adjuster **90** to clamp and lock the webbing **52** into, such as the first portion **52***a* of the webbing **52** located between the retractor **50** and the upper bracket **56**. The retractor **50** may lock the webbing **52**, such as by prohibiting rotation of the spool in a webbing extraction direction, whereby the forward momentum of the passenger or testing devices will load the webbing **52** and place the webbing **52** in tension. The forces induced by the tension drive the webbing against the forward facing surface **92***a* of the first member **92**, the rearward facing surface **94***a* of the second member **94**, and/or the forward facing surface **96***a* of the upper guide member **96**. The webbing **52** is also forced against a rearward surface **100***a* of the distal lower guide member **100** inducing a moment about a central portion of the webbing adjuster **90** causing the webbing adjuster **90** to rotate in a clockwise direction, as shown in FIGS. **11** and **14**. The rotation of the webbing adjuster **90** may drive the webbing **52** against the surfaces of the first and second members **92**, **94** with higher forces (e.g., pressures) increasing the friction forces between the friction elements of the members **92**, **94** and the webbing **52**. The friction elements of the first and second members **92**, **94** in effect grab or clamp the webbing to lock or fix the webbing adjuster **90** in position relative to the webbing **52** during the course of a dynamic vehicle event or testing. As such, the upper harness position is fixed and the portion **52***b* of the webbing **52** that extends from the upper bracket **56** to the tongue member **58** and/or buckle mechanism **64** is held in position behind the lower guide member **100**. Stated differently, the webbing adjuster **90** maintains its position relative to the webbing **52** to maintain a relatively constant length of the shoulder portion S of the webbing **52** during loading of the webbing **52**.

According to other exemplary embodiments, the webbing adjuster **90** may be made from different materials (e.g., metals, composites, other plastics, combinations thereof, etc.), be made according to other manufacturing methods (e.g., stamping, casting, forging, machining, etc.), be made from multiple assembled pieces, etc. Further, the webbing adjuster may be utilized in other applications, such as other types of motor vehicles.

The webbing adjuster **90** may, for example, advantageously allow the seat belt webbing to extract and retract efficiently without binding during normal vehicle use or operating conditions and maintain the position of the webbing relative to the webbing adjuster during loading (e.g., FMVSS 222 quasi-stating testing). The webbing adjuster **90** may also advantageously have a relatively small size, may be relatively light weight, may function without moving components (i.e., components of the webbing adjuster moving relative to other components of the webbing adjuster), may have an intuitive use and operation, which is relatively simple and cost-effective.

As utilized herein, the terms "approximately," "about," "substantially", and similar terms are intended to have a broad meaning in harmony with the common and accepted usage by those of ordinary skill in the art to which the subject matter of this disclosure pertains. It should be understood by those of skill in the art who review this disclosure that these terms are intended to allow a description of certain features described and claimed without restricting the scope of these features to the precise numerical ranges provided. Accordingly, these terms should be interpreted as indicating that insubstantial or inconsequential modifications or alterations of the subject matter described and claimed are considered to be within the scope of the invention as recited in the appended claims.

It should be noted that the term "exemplary" as used herein to describe various embodiments is intended to indicate that such embodiments are possible examples, representations, and/or illustrations of possible embodiments (and such term is not intended to connote that such embodiments are necessarily extraordinary or superlative examples).

The terms "coupled," "connected," and the like as used herein mean the joining of two members directly or indirectly to one another. Such joining may be stationary (e.g., permanent) or moveable (e.g., removable or releasable). Such joining may be achieved with the two members or the two members and any additional intermediate members being integrally formed as a single unitary body with one another or with the two members or the two members and any additional intermediate members being attached to one another.

References herein to the positions of elements (e.g., "top," "bottom," "above," "below," etc.) are merely used to describe the orientation of various elements in the FIGURES. It should be noted that the orientation of various elements may differ according to other exemplary embodiments, and that such variations are intended to be encompassed by the present disclosure.

It is important to note that the construction and arrangement of the assemblies as shown in the various exemplary embodiments are illustrative only. Although only a few embodiments have been described in detail in this disclosure, those skilled in the art who review this disclosure will readily appreciate that many modifications are possible (e.g., variations in sizes, dimensions, structures, shapes and proportions of the various elements, values of parameters, mounting arrangements, use of materials, colors, orientations, etc.) without materially departing from the novel teachings and advantages of the subject matter described herein. For example, elements shown as integrally formed may be constructed of multiple parts or elements, the position of elements may be reversed or otherwise varied, and the nature or number of discrete elements or positions may be altered or varied. The order or sequence of any process or method steps may be varied or re-sequenced according to alternative embodiments. Other substitutions, modifications, changes and omissions may also be made in the design, operating conditions and arrangement of the various exemplary embodiments without departing from the scope of the present invention.

What is claimed is:

**1**. A webbing adjuster for a seat belt system having a webbing, the webbing adjuster comprising:

a main body having a base and a guide portion configured to limit a forward movement of the webbing relative to the base, the base having a passage configured to route the webbing from a front side to a rear side of the base so that both a front side and a back side of the webbing contact the webbing and a frictional force is created between the webbing and the base; and

a lower guide member connected to the main body and configured to limit the forward movement of the webbing;

wherein when the webbing is not under load, the webbing adjuster is configured to be moveable relative to the webbing;

wherein when the webbing is under load, the frictional force between the base and the webbing is sufficient to secure the webbing to maintain a relative position between the webbing adjuster and the webbing.

**2**. The webbing adjuster of claim **1**, wherein the base includes a first member spaced apart from a second member defining the passage.

**3**. The webbing adjuster of claim **2**, wherein the first member includes a plurality of grooves located on the front side of the base.

**4**. The webbing adjuster of claim **2**, wherein the second member includes a plurality of projections located on the rear side of the base.

**5**. The webbing adjuster of claim **1**, further comprising an upper guide member connected to the body and configured to route the webbing from the rear side to the front side of the base.

**6**. The webbing adjuster of claim **5**, wherein the upper guide member is configured to limit a rearward movement of the webbing.

**7**. The webbing adjuster of claim **1**, wherein the lower guide member is configured at an angle relative to the base.

8. The webbing adjuster of claim 7, wherein the angle is a forward oblique angle.

9. A seat belt assembly for restraining an occupant of a vehicle, the seat belt assembly comprising:

a webbing; and

a webbing adjuster coupled only to the webbing, the webbing adjuster including a main body having a base portion and a guide portion, the base portion having a passage configured to route the webbing from a rear side to a front side of the base; and

wherein when the webbing is not under load, the webbing adjuster is configured to be moveable relative to the webbing;

wherein when the webbing is under load, a frictional force between the base and the webbing is sufficient to secure the webbing to maintain a relative position between the webbing adjuster and the webbing.

10. The seat belt assembly of claim 9,

wherein the base portion includes a first surface that engages a front side of the webbing, wherein the first surface has a first edge that engages the front side of the webbing at a first bend in the webbing;

wherein the base portion includes a second surface that engages a back side of the webbing, the second surface having a second edge that engages the back side of the webbing at a second bend in the webbing, wherein the first and second surfaces are configured so that the second bend of the webbing is in a different direction than the first bend of the webbing;

wherein the webbing adjuster is configured so that when the webbing adjuster is in a first position a frictional force between the webbing and the base portion is sufficient to prevent relative movement between the webbing adjuster and the webbing and to permit the occupant to manually change the position of the webbing adjuster by sliding the webbing adjuster along the webbing to thereby change the relative position of the webbing and the webbing adjuster;

wherein the webbing adjuster is configured to move into a second position when the occupant moves forward relative to a seat of the vehicle, wherein in the second position the webbing adjuster is rotated relative to the first position of the webbing adjuster; and

wherein the second surface includes a third edge, and wherein when the webbing adjuster is in the second position the third edge engages the back side of the webbing at a third bend in the webbing so that in the second position a frictional force between the webbing and the base portion is greater than the frictional force between the webbing and the base portion when the webbing adjuster is in the first position.

11. The system of claim 9, wherein the first and second surfaces are not parallel.

12. The system of claim 9, wherein the webbing adjuster further comprises:

two side walls;

a first cross member including the first surface;

a second cross member including the second surface; and

a front wall;

wherein each of the first cross member, the second cross member, and the front wall are connected to each of the two side walls.

13. The system of claim 12, wherein the side walls, the first cross member, the second cross member, and the front wall are integrally formed.

14. The system of claim 12, wherein the height adjuster further comprises:



a top passage formed between the first cross member and the front wall;

a rear passage formed between the first cross member and the second cross member; and

a bottom passage formed between the second cross member and the front wall.

15. The system of claim 14, wherein, in the first position, the webbing adjuster is configured so that the webbing passes through the rear passage and engages the first edge of the first cross member, passes between the second cross member and the front wall and engages the second edge of the second cross member, and passes through the bottom passage.

16. A webbing adjuster for a seat belt webbing, comprising:

a base including first and second surfaces configured to engage the webbing, wherein the first and second surfaces are positioned so that the first and second surfaces do not engage the webbing at the same location;

wherein the first surface engages a front side of the webbing to create a first bend in the webbing;

wherein the second surface engages a back side of the webbing to create a second bend in the webbing, wherein the first and second surfaces are configured so that the second bend of the webbing is in a different direction than the first bend of the webbing; and

wherein, when the webbing is under load, a frictional force between the first and second surfaces and the webbing is sufficient to secure the webbing to maintain a relative position between the webbing adjuster and the webbing.

17. The webbing adjuster of claim 16,

wherein the webbing adjuster is configured so that when the webbing adjuster is in a first position a frictional force between the webbing and the first and second surfaces is sufficient to prevent relative movement between the webbing adjuster and the webbing and to permit an occupant to manually change the position of the webbing adjuster by sliding the webbing adjuster and changing the relative position between the webbing and the webbing adjuster;

wherein the webbing adjuster is configured to move into a second position when the occupant moves forward relative to the seat, wherein in the second position the webbing adjuster is rotated relative to the first position of the webbing adjuster; and

wherein the second surface of the height adjuster in the second position further engages the back side of the webbing to create a third bend in the webbing so that in the second position a frictional force between the webbing and the webbing adjuster is greater than the frictional force between the webbing and the webbing adjuster when the webbing adjuster is in the first position.

18. The webbing adjuster of claim 16, further comprising:

two side walls;

a first cross member including the first surface;

a second cross member including the second surface; and

a front wall;

wherein each of the first cross member, the second cross member, and the front wall are connected to each of the two side walls.

19. The webbing adjuster of claim 18, wherein the first surface is positioned at a first distance from the front wall and the second surface is positioned at a second distance from the front wall, the first distance being greater than the second distance.

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